

EPA Superfund Explanation of Significant Differences:

**LAWRENCE LIVERMORE NATL LAB, MAIN SITE
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**Explanation
of Significant Difference
for the
Change to Granular Activated Carbon
for Treatment of Vapor at Treatment Facility F,
Lawrence Livermore National Laboratory,
Livermore Site**

June 15, 1993

Technical Editors

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1. Introduction

On August 5, 1992, the Record of Decision (ROD) was signed, documenting the final cleanup plan for the Lawrence Livermore National Laboratory (LLNL) Livermore Site in Livermore, California. As required under Section 117(c) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendment and Reauthorization Act of 1986 (SARA), and pursuant to 40 C.F.R. Section. 300.435(c)(2)(i) [Fed. Reg. Vol. 55, No. 46 (March 8, 1990)], this Explanation of Significant Difference (ESD) describes a change from the catalytic oxidation technology described in the ROD (DOE, 1992), to granular activated carbon (GAC) for treatment of fuel hydrocarbon (FHC) and volatile organic compound (VOC) vapors at Treatment Facility F (TFF). An ESD is required when significant, but not fundamental, changes are made to the final remedial action plan described in the ROD. This ESD describes information developed during the remedial design process that supports the subject change.

The lead agency for this ESD is the U.S. Environmental Protection Agency (EPA). This ESD includes a brief background of the LLNL Livermore Site, a summary of the remedy selected in the ROD, a description of how the noted change affects the remedy described in the ROD, and an explanation of why EPA and the U.S. Department of Energy (DOE)/LLNL are making this change to the selected remedy presented in the ROD. This document is designed to (1) provide the public with an explanation of the change made to the remedy as described in the ROD, (2) summarize the information that led to the change, and (3) affirm that the revised remedy complies with the statutory requirements of CERCLA Section 121. This ESD was prepared according to the following EPA Guidance Documents: *Guide to Addressing Pre-ROD and Post-ROD Changes* (EPA, 1991) and *Interim Final Guidance on Preparing Superfund Decision Documents* (EPA, 1989).

This ESD and supporting documentation will be placed in the LLNL repositories for interested members of the public to review. One repository is located at the Livermore Public Library, 1000 South Livermore Avenue. Library hours are Monday through Thursday, 10:00 a.m. to 9:00 p.m.; Friday and Saturday, 10:00 a.m. to 5:00 p.m.; and Sunday 1:00 p.m. to 5:00 p.m. The second repository is at the LLNL Visitors Center on Greenville Road. Visitors Center hours are Monday through Friday, 9:00 a.m. to 4:30 p.m.; and Saturday and Sunday 12:00 p.m. to 5:00 p.m. The Visitors Center also contains the Administrative Record, which is comprised of all the documents that form the basis for LLNL's cleanup plan.

DOE/LLNL provided a comment period for the EPA, the California Regional Water Quality Control Board (RWQCB), and the Department of Toxic Substances Control (DTSC) of the California Environmental Protection Agency to comment on this ESD. All comments and responses are presented in this ESD and will be included in the LLNL Administrative Record file. Pursuant to 40 C.F.R. Section 300.435(c)(2)(i), a public comment period is not required for an ESD, and all regulatory agencies overseeing the LLNL Livermore Site agreed that a public comment period was not necessary for this ESD.

2. Site Background

This section provides a brief description and history of the LLNL Livermore Site, chemicals of concern in the subsurface, and a summary of the remedy selected in the ROD. Further details can be found in the ROD and in the Administrative Record.

2.1. Site Description and History

LLNL is an 800-acre, multidisciplinary research facility owned by the DOE and operated and managed by the Regents of the University of California under contract with DOE. LLNL is located at 7000 East Avenue in southeastern Alameda County, approximately 3 miles east of the downtown area of Livermore, California (Fig. 1). The site is underlain by several hundred feet of complexly interbedded alluvial and lacustrine (lake) sediments. Depth to ground water at the site varies from about 120 ft in the southeast corner to about 25 ft in the northwest corner.

The LLNL site was converted from agricultural and cattle ranch land by the U.S. Navy in 1942. The Navy used the site until 1946 as a flight training base and for aircraft assembly, repair, and overhaul. Solvents, paints, and degreasers were routinely used during this period. Between 1946 and 1950, the Navy housed the Reserve Training Command at the site. In 1950, the Navy allowed occupation of the site by the Atomic Energy Commission (AEC), which formally received transfer of the property in 1951. Under the AEC, the site became a weapons design and basic physics research laboratory. In 1952, the site was established as a separate part of the University of California Radiation Laboratory. Responsibility for the site was transferred from AEC to the Energy, Research, and Development Administration in 1975. In 1977, responsibility for LLNL was transferred to the DOE, which is currently responsible for the site. In addition to weapons research, LLNL programs have been established in biomedicine, energy, lasers, magnetic fusion energy, and environmental sciences. Details of the site history and the use, storage and disposal of hazardous materials are presented in the Remedial Investigation (RI) (Thorpe *et al.*, 1990).

Initial releases of hazardous materials occurred at the LLNL site in the mid- to late 1940s when the site was the Livermore Naval Air Station (Thorpe *et al.*, 1990). There is also evidence that localized spills, leaking tanks and impoundments, and landfills contributed volatile organic compounds (VOCs), FHCs, possibly lead, chromium, and tritium to ground water and unsaturated sediment in the post-Navy era.

In 1987, the LLNL Livermore Site was added to the National Priorities List. In November 1988, DOE, EPA, DTSC, and RWQCB signed a Federal Facility Agreement, which named DOE as the overall lead agency and the U.S. EPA as the lead regulatory agency for cleanup.

2.2. Site Characteristics

A screening of all environmental media conducted for the RI (Thorpe *et al.*, 1990) showed that ground water and unsaturated sediment are the only media that require remediation. The identified compounds that exist in ground water at various locations beneath the site in concentrations above drinking water standards are:

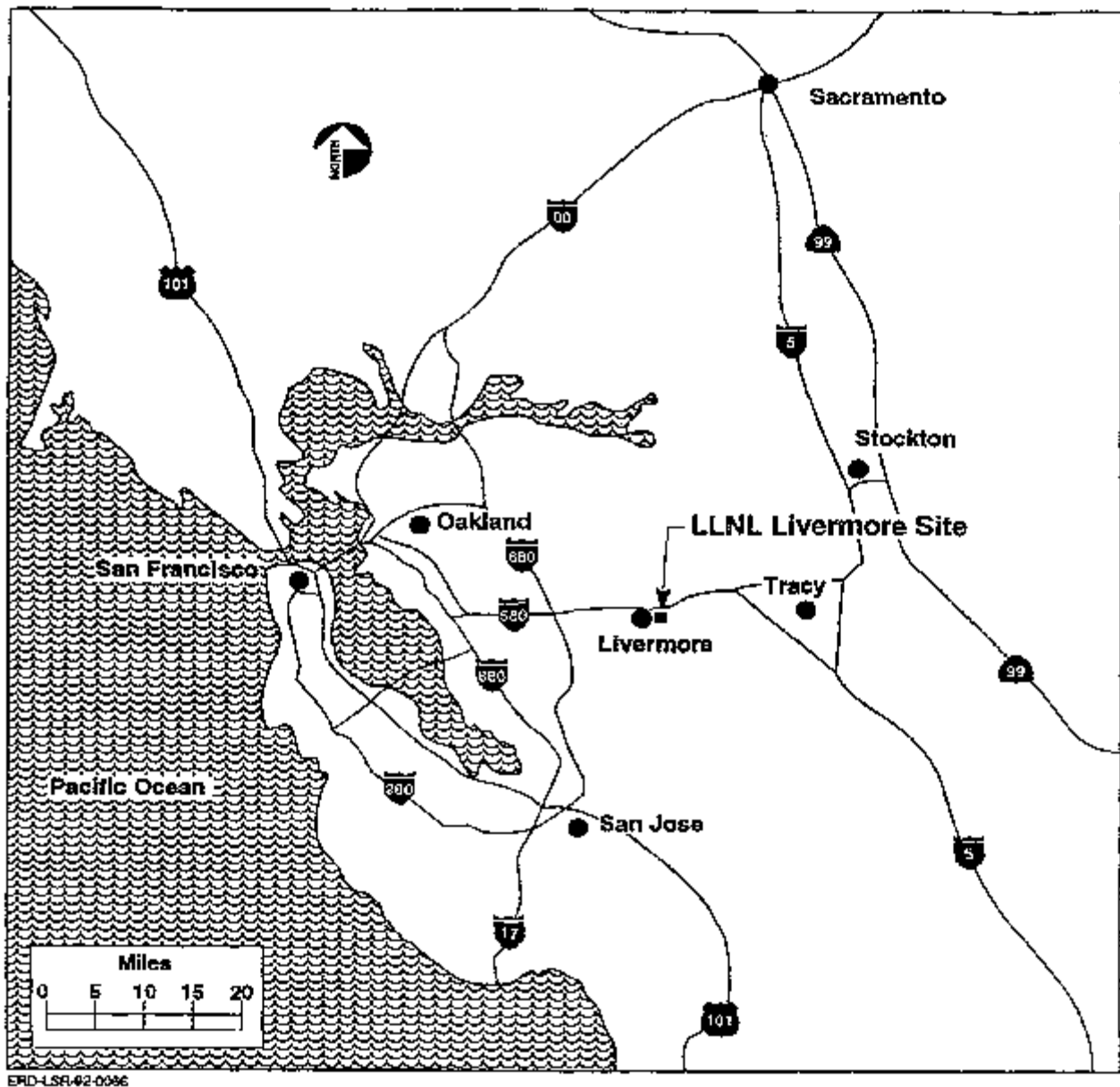


Figure 1. Location of the LLNL Livermore Site.

- The VOCs trichloroethylene (TCE), perchloroethylene (PCE), 1,1-dichloroethylene (1,1-DCE), 1,2-dichloroethylene (1,2-DCE), 1,1-dichloroethane (1,1-DCA), 1,2-dichloroethane (1,2-DCA), carbon tetrachloride, and chloroform.
- FHCs (leaded gasoline), including benzene, ethylbenzene, toluene, and ethylene dibromide.
- Chromium and possibly lead.
- Tritium.

The VOCs in ground water beneath LLNL, predominantly TCE and PCE, occur in relatively low concentrations that underlie about 85% of the LLNL site and a smaller area offsite, under a total area of about 1.4 square miles. Higher VOC concentrations are localized. Total VOC concentrations exceed 1 part per million (ppm) in ground water from only 10 out of a total of more than 300 wells. The calculated total volume of undiluted VOCs in ground water is less than 200 gal. VOCs are seldom found below a depth of about 200 ft.

FHCs occur almost exclusively where a leak of roughly 17,000 gal of leaded gasoline occurred from a U.S. Navy-era underground fuel tank in the southern part of the site. Total FHC concentrations in ground water range from 0.001 to 16 ppm, and are limited to an area within about 500 ft from the leak point.

Metals above Maximum Contaminant Levels (MCLs) are present in ground water in only a few locations. Chromium in ground water exceeds the MCL (Table 1) in 16 wells scattered in the northwest, central, and southwest parts of the study area and near Arroyo Seco, with a maximum concentration of 160 parts per billion (ppb) in the northwest corner. Lead has exceeded the 15-ppb remediation standard (Table 1) in only two wells in the Gasoline Spill Area in southern LLNL, at a maximum concentration of 38 ppb.

Tritium in ground water exceeds its MCL of 20,000 picocuries per liter (pCi/L) in only one well (MW-206). This occurrence of tritium is localized and well defined. Recent investigations have identified five additional areas where tritium concentrations in unsaturated sediments at LLNL are significantly elevated. However, the tritium activity in ground water in these areas is well below the MCL.

2.3. Remedies Selected in the ROD

The selected remedies for ground water and the unsaturated zone as described in the ROD are summarized below.

2.3.1. Ground Water

The selected ground water remedy involves initial pumping of water from a minimum of 24 locations within the ground water plume (Fig. 2). The total rate of ground water removed under this extraction plan is estimated to be about 350 gpm. Water will be pumped from one or more wells at each of the locations using existing monitor and extraction wells, along with new extraction wells. The initial well locations will be located near plume margins to prevent any VOCs from escaping from the area in concentrations above their MCLs (Table 1). To enable more

Table 1. Remediation standards and State discharge limits for compounds of concern in ground water at the LLNL site (from the Record of Decision).

Constituent	Concentration limit for drinking water ^a			Discharge limit ^b for treated water (ppb)
	Federal MCL (ppb)	California MCL (ppb)	Pre-remediation concentration range at LLNL, March 1990– March 1991 (ppb)	
PCE	5	5	<0.1-1,050	4
TCE	5	5	<0.1-4,800	5
1,1-DCE	7	6	<0.5-370	5
cis-1,2-DCE	70	6	<0.5-24	5 (total 1,2-DCE)
trans-1,2-DCE	100	10	<0.5-1	5
1,1-DCA	—	5	<0.5-60	5
1,2-DCA	5	0.5	<0.1-190	5
Carbon tetrachloride	5	0.5	<0.1-91	5
Total THM ^c	100 ^c	100 ^c	<0.5-270	5
Benzene	5	1.0	<0.1-4,600	0.7
Ethyl benzene	700	680	<0.2-610	5
Toluene	1,000	—	<0.5-4,200	5
Xylenes (total)	10,000	1,750 ^d	<0.5-3,700	5
Ethylene dibromide	0.05	0.02	<0.1-51	0.02
Total VOCs	—	—	up to 5,808	5
Chromium ⁺³	50 (total Cr) ^e	50 (total Cr)	<5-150 (total Cr)	50 (total Cr)
Chromium ⁺⁶	50 (total Cr) ^e	50 (total Cr)	<10-140	11
Lead	15 ^f	50	<2-10	5.6
Tritium ^g	20,000 pCi/L	20,000 pCi/L	<200-33,100	(h)

^a Human receptor. The more stringent concentration limits on this part of the table are shown in a larger typeface to illustrate that LLNL will comply with the most stringent requirements.

^b From National Pollutant Discharge Elimination System (NPDES) Permit No. CA0029289 (revised 8/1/90) and RWQCB Order No. 91-091. Of the LLNL compounds of concern, VOC specific State discharge limits exist in RWQCB Order No. 91-091 only for PCE (4 ppb), benzene (0.7 ppb), and ethylene dibromide (0.02 ppb). Other VOCs listed in this table are included in the 5 ppb total VOC limit. Discharge limits for metals differ slightly according to discharge location.

^c Total trihalomethanes (THMs); includes chloroform, bromoform, chlorodibromomethane, and bromodichloromethane (California Drinking Water Requirement).

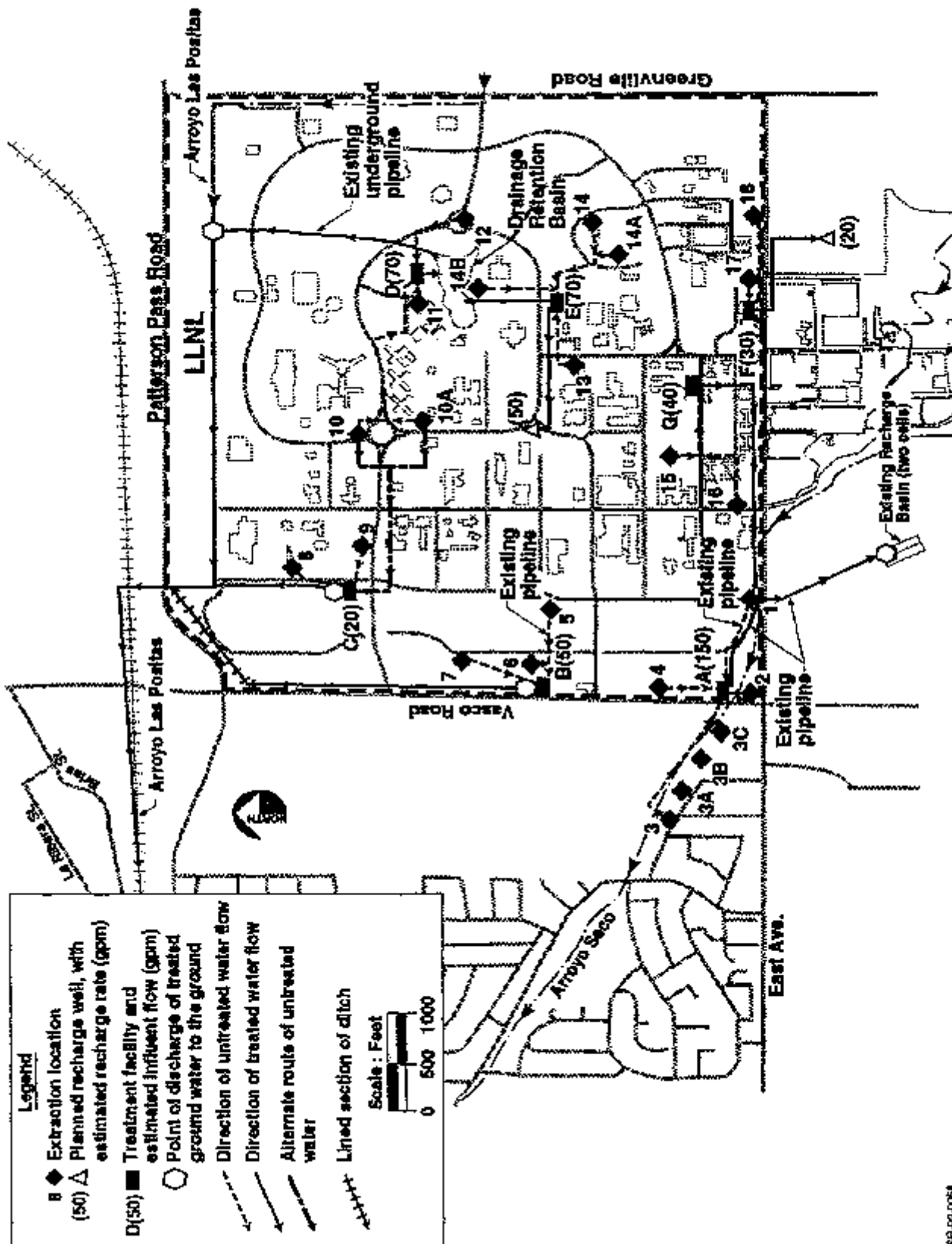
^d MCL is for either a single isomer or the sum of the ortho, meta, and para isomers.

^e National Interim Primary Drinking Water Regulation for total chromium is presently 50 ppb, but will increase to 100 ppb in July 1992. No MCLs exist for Cr⁺³ or Cr⁺⁶.

^f National Primary Drinking Water Regulation Enforceable Action Level (Federal Register, volume 56, number 110, June 7, 1991, p. 26460).

^g The RI shows that ground water in the one well that currently exceeds the tritium MCL will be naturally remediated long before it migrates offsite.

^h There is currently no NPDES discharge limit for tritium. LLNL will use the MCL for tritium as the discharge limit.



ERO-LRA 92-0054

Figure 2. Planned ground water extraction, recharge, and treatment facility locations.

rapid remediation, wells will also be placed in all areas where VOC or FHC concentrations in ground water exceed 100 ppb. Additional extraction locations may be added to ensure complete hydraulic capture of the plume, and/or to expedite cleanup, if field data and/or modeling indicate additional wells are necessary.

Seven onsite facilities (A to G) are planned to treat the extracted ground water (Fig. 2). Each treatment facility will be designed to treat a somewhat different combination of compounds. Treatment Facilities A, B, E, and F will use UV/oxidation as the primary treatment technology. Treatment Facilities C, D, and G will use air-stripping as the primary treatment technology. All facilities will use GAC to remove VOCs and FHCs from air streams, and, if necessary, TFF will use GAC to remove lead from ground water. Treatment Facility D and possibly Treatment Facility C will use ion exchange to remove chromium from ground water.

The selected alternative addresses all ground water containing VOCs in excess of MCLs and will assure that Applicable or Relevant and Appropriate Requirements for individual VOCs, FHCs, lead, chromium, and tritium will be achieved.

2.3.2. *Unsaturated Zone*

The selected remedy described in the ROD for the unsaturated zone is vacuum-induced venting to extract contaminant vapors from the unsaturated sediments and treating the vapors by catalytic oxidation. In this process, vapors from vent wells are heated and passed through a catalyst, where organic compounds are converted to harmless oxidation products, including carbon dioxide and water. As described in the ROD, if use of catalytic oxidation would result in emission of vapors with compounds above regulatory standards, secondary treatment or alternative technologies, such as GAC, would be evaluated and implemented to comply with regulatory standards.

3. Description of Significant Change to the Selected Remedy

This ESD changes one portion of the ROD. To the extent that this ESD differs from the ROD, it supersedes the ROD.

The treatment technology for treating VOC and FHC vapor at TFF was changed from catalytic oxidation to GAC, as described below. Table 2 presents the chronology of events regarding the change from catalytic oxidation to GAC from the time the ROD was signed to the present. Included in Table 2 are teleconferences, report submittals, and agreements reached with the regulatory agencies.

Characterization of the Gasoline Spill Area in the southern part of the LLNL site has been underway since 1983, and vadose zone pilot remediation by vacuum extraction has been underway since 1988. For the pilot remediation, extracted FHC vapors from the subsurface were oxidized with a permitted propane-fired burner or thermal oxidizer. VOCs (low concentrations of TCE and 1,2-DCA) are also present in the ground water containing FHCs.

At the time the RI (Thorpe *et al.*, 1990) and Feasibility Study (Isherwood *et al.*, 1990) were being prepared, long-term plans called for the construction of TFF in the Gasoline Spill Area to treat free-phase gasoline; FHCs and VOCs in ground water; and FHCs in the vadose zone. However, LLNL Environmental Restoration staff had concerns that thermal treatment of

Table 2. Chronology of events regarding change to granular activated carbon (GAC) from catalytic oxidation for Treatment Facility F.

Date	Event
August 5, 1992	Record of Decision (ROD) is signed incorporating catalytic oxidation as the method to treat VOC and FHC vapors from unsaturated sediments.
October 22, 1992	LLNL Engineering Group determines that there are insufficient resources to perform the EPA-required catalytic oxidation treatability studies prior to beginning the Dynamic Stripping Demonstration Project (Aines <i>et al.</i>, 1992). In addition, with the availability of onsite steam GAC regeneration, use of GAC is determined to be more cost-effective than catalytic oxidation.
October 23, 1992	Teleconference between Bella Dixon of DOE and Michael Gill of EPA. The potential for a ROD amendment to implement the change is discussed.
October 27, 1992	Preliminary Draft Final Remedial Action Implementation Plan (RAIP) sent to DOE for review with change to GAC included.
November 3, 1992	Change to GAC is discussed with EPA and DTSC during regulatory teleconference.
November 6, 1992	Draft Final RAIP is sent to regulators including the change to GAC.
December 2, 1992	It is agreed at a meeting with DOE, LLNL, EPA, DTSC, and the RWQCB that a ROD amendment is not necessary and that an Explanation of Significant Difference (ESD) is the most appropriate way to implement the change to GAC.
December 10, 1992	Comments on Draft Final RAIP received from regulators. Mention of ESD in the RAIP is recommended.
December 14, 1992	RAIP and ESD discussed during teleconference with regulatory agencies.
January 6, 1993	RAIP is issued, including mention of an ESD to explain change from catalytic oxidation to GAC.
January 21, 1993	It was agreed that the Draft ESD would be due on February 23 to the regulatory agencies during a regulatory teleconference.

halogenated VOCs with FHCs could produce dioxins in the effluent of the thermal oxidizer. This concern was voiced during the conceptual design phase of TFF, circa 1991.

Thermal oxidation of aromatic compounds, such as benzene, in the presence of chlorinated VOCs, such as TCE, can produce tetrachlorodibenzo-para-dioxin (TCDD). However, it has been demonstrated that a recently developed catalyst efficiently destroys FHCs and halogenated VOCs including dichlorobenzene (a surrogate for dioxin) (Lester, 1989). The oxidation of the halogenated compounds also produces minor amounts of hydrogen chloride (HCl) and hydrogen bromide (HBr), which can be removed by a caustic scrubber. The lower temperature of a catalytic oxidizer (700EF versus 1,800EF for the thermal oxidizer) makes caustic scrubbing much easier. In addition, one-third of the supplemental fuel is required for a catalytic oxidizer compared to the thermal oxidizer. As described in the Proposed Remedial Action Plan (Dresen *et al.*, 1991) use of a catalytic oxidizer would provide the flexibility to treat both FHCs and VOCs together, and would substantially reduce the potential for producing dioxin compared to thermal oxidation.

The GAC vapor treatment option, however, has no risk of producing TCDD. GAC is an effective treatment alternative for FHC vapor and is considered Best Available Control Technology (BACT) by the Bay Area Air Quality Management District (BAAQMD). At TFF, vapors are induced into the treatment system from the subsurface by a liquid ring vacuum pump capable of 400 cubic feet per minute. The liquid ring pump exhausts to a demister, which collects water. The vapor stream is passed through one of two 750-lb GAC canisters where FHCs, such as benzene, are sorbed. The treated vapors pass a continuous-reading FHC sensor prior to discharge to the atmosphere. Valves direct the vapor flow to the second GAC canister while the first is being regenerated after a prescribed time that is based on GAC loading rate, or when breakthrough is detected by a sensor linked to a control system. The first canister is flushed with steam to heat the carbon, and to desorb and remove the FHCs. The steam and FHCs are removed from the canister and condensed with a plate-type heat exchanger, which is cooled by clean process water. The condensed steam (water) and FHCs are collected in a separation tank. Level switches within the separation tank activate pumps for discharge to separate collection tanks for light (lighter than water, such as benzene) and heavy (heavier than water, such as TCE) compounds. Details of the remedial design will be addressed in a later design document that will be subject to regulatory review.

The cost of using GAC for vapor treatment at TFF is estimated to be about half of the original catalytic oxidation cost estimate. Table 3 presents the original catalytic oxidation cost estimate, a revised estimate for catalytic oxidation after receiving comments from EPA, and the estimated cost for vapor treatment by GAC with onsite regeneration. The increase in engineering cost of catalytic oxidation is due to the additional engineering requirements for treatability and start-up tests required by the EPA. Overall, the costs for catalytic oxidation increased by approximately 45% due to this treatability testing and reporting. There are no treatability studies required for the GAC treatment option. Therefore, the cost of GAC is far less than catalytic oxidation, and the use of GAC enables TFF to start operation ahead of the scheduled March 1993 date in the Remedial Action Implementation Plan (Dresen *et al.*, 1993).

All appropriate and relevant regulatory requirements, including air emission limits and monitoring requirements, disposal of secondary wastes, and any other substantive requirements that apply to the treatment will be followed during operation of the treatment facility. The

BAAQMD discharge limits for TFF are 6 ppm_{v/v} for the vapor treatment system and 10 ppm_{v/v} for the ground water treatment system.

In summary, the change from catalytic oxidation to GAC for treatment of vapor at TFF eliminates the possibility of dioxin production, is more cost-effective with current onsite GAC regeneration equipment, and enables earlier operation of TFF.

Table 3. Comparison of estimated costs for catalytic oxidation and granular activated carbon (GAC).

Component	Original catalytic oxidation unit with scrubber	Original catalytic oxidation unit and EPA requirements	GAC w/onsite regeneration
Purchase	\$250,000	\$250,000	\$140,000
Engineering	25,000	70,000	25,000
Treatability ^a	0	80,000	0
Activation	60,000	60,000	40,000
Start up testing ^b	20,000	80,000	20,000
Utility connections	80,000	80,000	0
Reporting	10,000	20,000	10,000
Air permitting	20,000	20,000	10,000
Dioxin analysis (treatability and start-up)	5,000	20,000	0
FHC and VOC analyses	2,000	4,000	2,000
Totals	\$472,000	\$684,000	\$247,000
Percent change over original catalytic oxidation estimate		45	-48

^aIncludes treatability work plan, quality assurance plan, and detailed performance testing at manufacturer's facility (varying operating parameters such as residence time and reactor temperature).

^bIncludes detailed performance testing of installed unit.

4. Regulatory Agency Comments and Responses

4.1 Responses to Department of Toxic Substances Control Comments

Comment 1: *Both the thermal oxidation and catalytic oxidation systems can treat both VOCs and FHCs. The ESD does not indicate that the GAC system can treat FHC. How can the GAC system be justified if it cannot treat the compounds which will be in the vapor waste stream?*

The GAC vapor treatment system is an effective treatment alternative for FHCs and is in fact considered BACT by the BAAQMD for this purpose. Changes have been made in paragraph 6 in Section 3 of the Draft Final ESD to make it clear that GAC successfully treats FHCs.

Comment 2: Page 9, Third Paragraph, Fifth Sentence: *What is the purpose of the VOC sensor? What type of sensor is used? How often is it monitored? How will FHCs be monitored?*

The FHC (rather than VOC) sensor ensures that hydrocarbon concentrations in the treated vapor effluent are below the BAAQMD discharge limits. The BAAQMD discharge limits for TFF are 6 ppm_{v/v} for the vapor treatment system and 10 ppm_{v/v} for the ground water treatment system. The sensor is a Sierra Monitor Model No. 4100-31, solid state FHC sensor calibrated with representative vapor samples for weathered gasoline. It is continuously monitored by the control system. The BAAQMD will provide feedback on the appropriateness of this sensor. VOCs are not monitored because VOC concentrations in extracted vapor are extremely low compared to FHCs, and FHCs would break through the GAC long before VOCs. Paragraph 6 in Section 3 of the Draft Final ESD has been modified to indicate that an FHC rather than VOC sensor is used.

Comment 3: Page 9, Third Paragraph, Sixth Sentence: *How is it possible for a distribution control system to detect chemical breakthrough in the GAC cansiters?*

The control system operates electronically and continuously monitors the voltage signals from the above-mentioned FHC sensor and various other monitoring devices. The voltage signals are processed by a preprogrammed logic circuit capable of triggering certain controls, such as pneumatically operated diverter valves that direct the vapor flow into either of the GAC vessels.

The text in Paragraph 6 in Section 3 has been modified to indicate that “breakthrough is detected by a sensor linked to a control system.”

Comment 4: Page 9, Third Paragraph, Sixth Sentence: *Is the first canister flushed with stream (sic) as the vapor stream from the subsurface is being passed through it? How is the second canister treated to desorb and remove the VOCs?*

The TFF GAC vapor treatment system consists of two vessels, each containing 750 lb of GAC, which are alternated between vapor treatment and steam regeneration. While one vessel is treating the extracted vapor stream, the other is being regenerated with steam. The text in Paragraph 6 of Section 3 has been modified to make it clear that flow is directed to the second GAC canister while the first is being regenerated.

Comment 5: Page 9, Third Paragraph, Last Sentence: *How are the FHCs which may have been collected in the separation tank removed from the waste stream.*

The regeneration waste stream is first condensed into liquid in a plate heat exchanger, and then routed through a product separator that removes both free-phase FHCs (lighter than water) and VOCs (heavier than water). The product separator is a relatively stagnant tank that allows gravitational separation of hydrophobic compounds, which are removed from above and below the aqueous portion of the fluid. The water effluent from the separator, which contains dissolved concentrations of FHCs and VOCs, is routed into the ground water treatment system influent.

Free-phase VOCs and FHCs are collected in 55-gal drums and disposed by the LLNL Hazardous Waste Management Division according to regulatory standards.

4.2 Responses to Regional Water Quality Control Board Comments

Comment 1: *The change from catalytic oxidation to granular activated carbon (GAC) units to treat the vapors from Treatment Facility F is acceptable to the agency.*

Comment noted.

Comment 2: *The description of the GAC vapor treatment system on page 9 does not specify that the unit will also treat the fuel hydrocarbon vapors from Treatment Facility F. Please address this issue.*

See response to DTSC Comment No. 1.

Comment 3: *The brief description of the design and operation of the GAC units does not contain enough detail for the agency to comment on or approve the design as outlined in this document. Our agency has several comments and questions regarding the determination of breakthrough and the disposal of the discharge products from the flushing of the GAC units. However, is it appropriate to address specific design issues of the GAC units within the Explanation of Significant Difference (ESD) document? If design specifications are required in the ESD, then a more complete description of the operation of the GAC units should be included. If not, then a brief description of the GAC's ability to sorb contaminants and the proposal to regenerate the carbon onsite should be sufficient to approve the general technology. The specifics of the design and operation should be proposed to the regulatory agencies in the Remedial Design document.*

As discussed with Elizabeth Adams of the RWQCB, the following sentence has been added to the end of Paragraph 6 in Section 3: "Details of the remedial design will be addressed in a later design document that will be subject to regulatory review."

Comment 4: *This document should state that all appropriate and relevant regulatory requirements, such as air emission limits and monitoring requirements, disposal of secondary wastes generated by the alternate technology and any other substantive requirements that apply to the treatment chain will be followed during operation of the treatment facility.*

Similar language to that suggested in this comment has been added to the end of Section 3 of the Draft Final ESD.

4.3 Responses to U.S. Environmental Protection Agency Comments

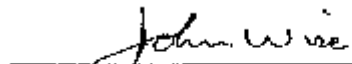
Comment 1. The ESD needs to be signed by representatives of the U.S. EPA and the U.S. Department of Energy.

Signature blocks for representatives of these agencies have been added to Section 5 of the Draft Final ESD.

5. Statutory Determinations

Considering the new information that has been developed and the change that has been made to the selected remedy, EPA and DOE/LLNL believe that the remedy remains protective of human

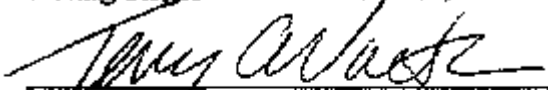
health and the environment, complies with Federal and State requirements that were identified in the ROD as applicable or relevant and appropriate to this remedial action, and is cost-effective. In addition, the revised remedy uses permanent solutions and alternative treatment technologies to the maximum extent practical for this site. The change contained herein is significant, but does not fundamentally change the remedy.



John Wise
Acting Regional Administrator, EPA Region IX

8.23.93

Date



Terry A. Vaeth
Acting Manager, DOE San Francisco
Operations Office

8/5/93

Date

6. Public Participation Activities

DOE has presented this change to the remedy in the form of an ESD because the change is of a significant, but not fundamental, nature. DOE provided the EPA and State regulatory agencies with a comment period on this ESD. In accordance with Section 117(c) of CERCLA, 42 U.S.C. Section 9617(c), DOE will publish a notice in the local newspaper, which describes this ESD and its availability for review at the LLNL repositories. This ESD and all documents that support the change herein are contained in the Administrative Record for the LLNL site.

7. References

- Aines, R., R. Newmark, W. McConachie, K. Udell, D. Rice, A. Ramirez, W. Siegel, M. Buettner, W. Daily, P. Krauter, E. Folsom, A. Boegel, and D. Bishop (1992), *Dynamic Underground Stripping Demonstration Project, Interim Progress Report 1991*, Lawrence Livermore National Laboratory, Livermore, Calif (UCRL-ID-109906).
- Dresen, M.D., J.P. Ziagos, A.J. Boegel, and E.M. Nichols (Eds.) (1993), *Remedial Action Implementation Plan for the LLNL Livermore Site*, Lawrence Livermore National Laboratory, Livermore, Calif. (UCRL-AR- 110532).
- Dresen, M.D., W.F. Isherwood, and J.P. Ziagos (1991), *Proposed Remedial Action Plan for the LLNL Livermore Site*, Lawrence Livermore National Laboratory, Livermore, Calif. (UCRL-AR-105577).
- Isherwood, W.F., C.H. Hall, and M.D. Dresen (Eds.) (1990) *CERCLA Feasibility Study for the LLNL Livermore Site*, Lawrence Livermore National Laboratory, Livermore, Calif. (UCRL-AR-104040).
- Lester, George R. (1989) *Allied Signal Catalytic Destruction of Hazardous Halogenated Organic Compounds*, Air and Waste Management Association, 82nd Annual Meeting and Exposition, June 25-30, 1989, Anaheim, Calif.
- Thorpe, R.K., W.F. Isherwood, M.D. Dresen, and C.P. Webster-Scholten (Eds.) (1990), *CERCLA Remedial Investigations Report for the LLNL Livermore Site*, Lawrence Livermore National Laboratory, Livermore, Calif. (UCAR-10299).
- U.S. Environmental Protection Agency (EPA) (1991), *Guide to Addressing Pre-ROD and Post-ROD Changes*, Office of Solid Waste and Emergency Response, Publication 9355.3-02, April 1991.
- U.S. Environmental Protection Agency (EPA) (1989), *Interim Final Guidance on Preparing Superfund Decision Documents*, Office of Solid Waste and Emergency Response, Directive 9335.3-02.
- U.S. Department of Energy (DOE) (1992), *Record of Decision for the Lawrence Livermore National Laboratory, Livermore Site*, Lawrence Livermore National Laboratory, Livermore, Calif. (UCRL-AR-109105).